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NOTES FROM PACIFIC COAST OBSERVATORIES.

THE ZEEMAN AND STARK EFFECTS.

The important discovery by STARK of the effect of an electric field on radiation is of the greatest interest to the physicist, and may prove of equal value to the astronomer. Altho the observed phenomena are in some respects closely analogous to those of the Zeeman effect, there are significant points of distinction which make it possible to determine with certainty whether an electric or a magnetic field is the producing cause. The most important criterion, in cases where the magnetic or electric fields are too weak to produce complete separation, is afforded by the fact that whereas in the Zeeman effect the outer components of a magnetic triplet are circularly polarized when observed in the direction of the lines of force, the components of an electrically resolved line are unpolarized under similar conditions of observation. Thus, disregarding other points of difference, the presence of circularly or elliptically polarized light, if not of instrumental origin, will serve as a sufficient criterion.

In sun-spot triplets, for example, the two outer components are circularly or elliptically polarized in opposite directions, the polarization being so pronounced that either component can be cut off at will in the case of spots lying near the center of the Sun. Furthermore, a wide variety of tests give all of the other peculiarities which the Zeeman effect would lead us to expect. The general magnetic field of the Sun is too weak to resolve the lines into their separate components, but the displacements which have led to its detection result from the fact that the overlapping components are elliptically polarized. Thus, in both cases, there can be no doubt that the observed phenomena are due to a magnetic rather than an electric field.

As for the possibility of detecting the existence of electric fields in the Sun by means of the Stark effect, the existing evidence appears to be negative. In view of the powerful magnetic fields in sun-spots, it seems probable that electric fields of considerable intensity may also be found there. I have examined our photographs of spot spectra with the object of detecting any anomalies ascribable to the Stark effect, but so far without success. Comparatively few of these photographs, however, were taken for the study of plane polarization effects, and in these cases the spots observed were at some distance from the center of the Sun. It will be necessary to repeat the observations with special polarization apparatus in the case of sun-spots lying near the Sun's center and elsewhere, and also to extend them to the chromosphere, with special reference to its lower levels. At present it can only be said that if the Stark effect exists in the Sun its magnitude appears to be so small that special methods, similar to those employed in the study of the general magnetic field, will be required to detect it. Polarizing apparatus suitable for this purpose is described in a paper read before the American Philosophical Society on April 24th.¹

GEORGE E. HALE.

PRELIMINARY NOTE ON THE DISSYMMETRY OF LINES IN THE
SPECTRUM OF THE CONDENSED SPARK.

That the strongly condensed spark gives spectrum lines which in general are stronger on the red side is well known. It is difficult to make accurate micrometer settings on such lines, so that spark spectra to be measured are usually obtained with considerable inductance in the circuit, which sharpens the lines and at the same time reduces the tendency toward dissymmetry. As the effect is not easily measured by our usual methods and can be minimized when desired, it has not taken its place as an active agency in the displacing of lines. When a displacement is observed, the probable influences of pressure and of motion in the line of sight are first considered. The condition is to

¹ Soon after the appearance in *Nature* of the first announcement of his discovery, I wrote to Professor STARK regarding the determination of the effect for the lines of iron, chromium and other metals found at low levels in sun-spots and the solar atmosphere, where intense electric fields may exist. He replied that the absence of series lines in their spectra had led him to omit them from his preliminary program, but that he would endeavor to observe the effect for these elements during the coming summer.